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(19) Europäisches Patentamt
European Patent Office
Office uropéen des brevets

(11) EP 0 761 091 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.03.1997 Bulletin 1997/11

(51) Int. Cl.[6]: **A01J 7/02**, B08B 9/03

(21) Application number: **96202430.3**

(22) Date of filing: **02.09.1996**

(84) Designated Contracting States:
BE DE FR GB IT NL SE

(30) Priority: **08.09.1995 NL 1001158**

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(54) A method of cleaning a milk line system

(57) The invention relates to a method of determining the extent to which a milk line system is rinsed with a cleaning fluid, whereby in one or more places in the milk line system the electric conductivity of the cleaning fluid is determined. More in particular, according to the invention, the electric conductivity is measured in places which are difficult to reach for the cleaning fluid and/or in places in the milk line system which are sensible to disturbances

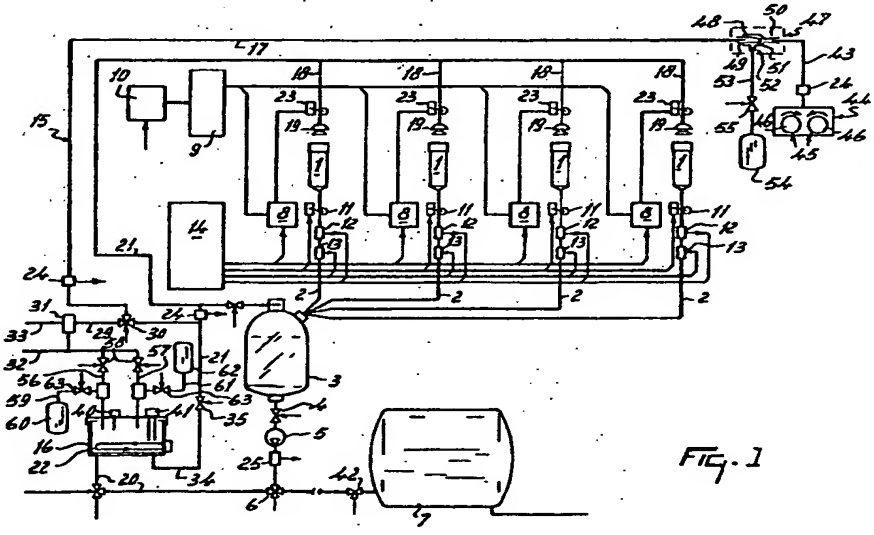

FIG. 1

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milking machines, the line system is cleaned after the herd has been milked. In the case of a milking robot, the milk line system is cleaned e.g. after a certain period of time has elapsed or a predetermined number of animals has been milked. Furthermore the milk line system may also be cleaned when it has been ascertained that milk produced by an animal which is e.g. infected with mastitis is discharged by the line.

The cleaning of the milk line system is to be divided into three phases, i.e.: the pre-rinsing, the main cleaning and the post-rinsing. The pre-rinsing serves to remove the milk residues as much as possible from the equipment prior to the main cleaning. Consequently, the main cleaning will require less detergent. In order to achieve this, the pre-rinsing should not be a circulation rinsing. For the pre-rinsing there is used water having a temperature of 40° to maximum 60° C. The pre-rinsing is succeeded by the main cleaning. The main cleaning serves to clean and disinfect the equipment. This is realized by circulating a cleaning fluid. The cleaning is mostly effected with an alkali having a cleaning and/or disinfecting function. In order to avoid formation of scale in the milk line system, said system has also to be cleaned from time to time with an acid. With the acid, scale formed in the milk line system, e.g. on the electrodes of a milk conductivity sensor, can be dissolved and thus removed from the milk line system. After the main cleaning, the milk line system has to be cleaned by means of post-rinsing. This is to prevent residues of the cleaning fluid from coming into the milk. The post-rinsing is effected with tap water. The post-rinsing water should preferably not circulate.

In practice it has appeared that during cleaning of the milk production equipment there are made mistakes, as a result of which this equipment is cleaned insufficiently and consequently the germ count of the milk more than doubles. This may be caused by an insufficient quantity of alkali or acid, or by insufficient post-rinsing, or by the fact that certain places are not reached by the cleaning fluid, because e.g. a tube is pinched off, etc.

The invention aims at obtaining a method, in which the above-mentioned drawbacks do not occur or are at least limited to a considerable extent.

In accordance with the invention, this is achieved by means of a method of determining the extent to which a milk line system is rinsed with a cleaning fluid, whereby in one or more places in the milk line system the electric conductivity of the cleaning fluid is measured, after which the purity of the cleaning fluid is defined. In this manner, the cleaning of the milk line system is verified.

According to a further method in accordance with the invention, the electric conductivity is measured in a line connected to a teat cup In practice this place has appeared to be sensible to disturbances and difficult to reach.

According to a further inventive feature, on the basis of the results of the electric conductivity measuring, the concentration of the solvent present in the cleaning fluid is determined. On the basis of the measuring results it can be checked whether the concentration of solvent is insufficient or excessive. The solvent added to the cleaning fluid is preferably an acid or an alkali. According to a further inventive feature, the concentration of alkali or the concentration of acid is determined. According to again an other inventive feature, after the concentration of alkali or acid has been determined, this concentration is compared with a predetermined value for the concentration of alkali/acid and, when said value is not reached, alkali or acid is added to the cleaning fluid until the relevant value has been reached, while, when this value is exceeded, there is added cleaning fluid until the predetermined value has been reached. The correct concentration of the detergent is important for a proper cleaning, for a lower quantity decreases the cleaning function, whereas a higher quantity results in an unnecessarily high consumption and a heavy burdening of environment.

According to again an other inventive feature, there is applied a method in which, after the milk line system has been rinsed with a cleaning fluid, the milk line system is post-rinsed with a post-rinsing fluid and, during post-rinsing, the concentration of alkali or acid in the milk line system is determined and compared with a predetermined minimum value for the concentration of alkali or acid, and the post-rinsing of the milk line system is only ended when the minimum value has been reached. In this manner, residues of the cleaning fluid can be prevented from coming into the milk and affecting the quality thereof.

The invention also relates to a method characterized in that the milk line system is rinsed with a calibration fluid containing a concentration of alkali or acid known beforehand and that this calibration value is compared with the value of alkali or acid measured in the milk line system and that, when the measured value deviates from the calibration value, the means by means of which the electric conductivity of the fluid is measured are calibrated. In practice it has appeared that the aforementioned means show deviations after some time. These deviations are e.g. caused by substances present in the milk, which deposit on the means

and which, during cleaning, are unsufficiently removed. Wear of the means may also occur. By calibrating the means again, it will again be possible to carry out a reliable measuring by means of same.

The invention furthermore relates to an implement for applying a method as mentioned above, whereby the implement comprises a milk line system with one or more milk conductivity sensors included therein. In practice these milk conductivity sensors are used for checking the milk for e.g. mastitis. In the present invention, the milk conductivity sensors known per se are utilized for an other application, i.e. for checking the cleaning of the milk line system.

In accordance with a further inventive feature, the implement comprises a milk line system in which one or more teat cups are included. According to again an other inventive feature, there is disposed a milk conductivity sensor in the milk line of a teat cup. In a preferred embodiment according to the invention, each milk line that is connected to a teat cup is provided with a milk conductivity sensor. In this manner an optimal check of the cleaning of the milk lines of the teat cups can be carried out. In accordance with again an other inventive feature, the implement comprises a milking robot for automatically connecting teat cups to the teats of an animal respectively disconnecting same therefrom. The application of a method as described above in an implement including a milking robot and a milk line system has great advantages, because the milking robot operates during a long time without the supervision of an operating person and hence the cleaning of the milk line system is checked without the presence of an operating person.

It will be clear that the above mentioned methods of determining the extent to which a milk line system is rinsed with a cleaning fluid is also applicable to a line system with any other fluid than milk. The invention therefore also relates to a method of determining the extent to which line system is rinsed with a cleaning fluid, whereby in one or more places in the line system the electric conductivity of the cleaning fluid is measured, after which the purity of the cleaning fluid is defined.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to an embodiment as represented in the accompanying Figure 1, in which an implement for automatically milking animals is shown schematically, whereby only those parts of the implement are represented that are of importance for the understanding of the present invention. It will be obvious that the invention is by no means restricted to the embodiment shown and described here; it only serves to illustrate the inventive idea.

In the implement shown in Figure 1 the teat cups are indicated by the reference numeral 1. These teat cups are each provided with a lining of flexible material, by means of which the teat space of a teat cup is separated from the pulsation space. By means of a non-shown milking robot, the teat cups 1 can automatically be connected to the teats of an animal respectively be disconnected therefrom. To the teat space of each of the teat cups 1 there is connected a milk line 2. All these milk lines 2 debouch into a milk glass 3. Via a valve 4, a pump 5 and a valve 6, the milk glass 3 is in communication with a milk tank 7. For each of the teat cups 1 there is available a pulsator 8, which, during milking, applies a pulsating underpressure stimulating the milk yield in the pulsation space of the relevant teat cup 1. Each of the pulsators 8 is connected to a vacuum balance tank 9, in which, by means of a motor driven pump 10, a stabilized underpressure is generated. In each of the milk lines 2 connected to the teat cups 1 there are included consecutively a close-off element 11, a vacuum sensor 12 and a milk conductivity sensor 13. By means of the milk conductivity sensor 13 the electric conductivity of the milk and a rinsing fluid can be determined. Furthermore the implement comprises a computer 14, by means of which the various parts of the implement for automatically milking are controlled. For the purpose of rinsing the implement is provided with a rinsing circuit 15, constituted by a rinsing fluid tank 16, a rinsing fluid supply line 17, separate rinsing fluid supply lines 18, each of which is connected to the rinsing fluid line 17, and by rinsing jetters 19, connected to the separate rinsing fluid supply lines 18, to which rinsing jetters 19 the teat cups 1 can be connected. In order to obtain a closed rinsing circuit, the milk glass 3 is capable of being connected, via the valve 6 and a return line 20, to the rinsing fluid tank 16. By means of a rinsing fluid line 21 there can furthermore directly be obtained a shortened rinsing circuit through the milk glass 3. In the rinsing fluid line 21 there is further included a conductivity sensor 24, by means of which also the electric conductivity of the rinsing fluid can be determined. By means of a heating element 22 in the rinsing fluid tank 16, water of preferably 40 to 60° C containing a detergent can be sucked by the underpressure in the milk glass 3, via the rinsing fluid supply line 17, the separate rinsing fluid supply lines 18, the rinsing jetters 19, the teat cups 1 and the milk lines 2. This rinsing fluid is then pumped back, via the valve 4, by means of the pump 5 and via the valve 6, to the rinsing fluid tank 16. When the rinsing fluid is passed through the separate rinsing fluid supply lines 18, it may occur that the quantities of rinsing fluid, passing through the various teat cups, differ from each other to a considerable extent. Hence there is included a close-off element 23 in each of the rinsing fluid supply lines 18. Each close-off element 23 is under control of a pulsator 8. The pulsators 8 can be controlled by the computer 14 in such a way that the close-off elements 23 connected to the relevant pulsators consecutively release and close off the rinsing fluid supply lines 18, so that the rinsing fluid is passed, consecutively in time, through the respective teat cups 1. In order to optimize the rinsing of the teat cups, the temperature of the rinsing fluid is maintained as constant as possible during rinsing. For that purpose there is included a temperature sensor 25

in the rinsing circuit 15. Said temperature sensor is in communication with the computer 14, which controls the heating element 22 in the rinsing tank.

In the implement, there is moreover connected to the rinsing fluid supply line 17 a first supply line 29 for rinsing fluid, such as water. In the first supply line 29 there is included a computer-controlled valve 30. In order to be able to control the temperature of the rinsing fluid, the first supply line 29 includes a thermostatically controlled tap 31, to which a hot water line 32 and a cold water line 33 are connected. By means of the computer 14, for the purpose of pre-rinsing the milk lines, the teat cups and the milk glass, the thermostatically controlled tap 31 is adjusted to a temperature of the rinsing fluid lying between 32 and 42° C and amounting preferably to approximately 37° C, and the computer-controlled valve 30 is opened during approximately 5 to 7 minutes.

To the rinsing fluid line 17 there is furthermore connected a second supply line 34, extending via the rinsing fluid tank 16, for a further rinsing fluid. The second supply line 34 also comprises a valve 35 controlled by the computer 14.

The rinsing fluid tank 16 comprises a heating element 22, controlled by a thermostat 40, by means of which the water can be heated to a temperature of approximately 78° C, which temperature is very suitable for heat cleaning. In order to prevent the rinsing fluid tank 16 from boiling dry, said rinsing fluid tank comprises fluid level pins 41 supplying a signal to the computer 14 when there is no water in the rinsing fluid tank 16 or the quantity of water therein is insufficient. Near the milk glass 3, there is additionally included in the rinsing circuit a milk conductivity sensor 24, by means of which the electric conductivity of the rinsing fluid can be measured, which measuring is supplied to the computer 14.

For discharging the rinsing fluid e.g. into the sewer, the rinsing circuit comprises another two computer-controlled valves 42.

The computer-controlled valve 30 is designed as a three-way valve. To the rinsing fluid line there is connected a further rinsing fluid line 43, by means of which rinsing fluid conveyed via the first supply line 29 can be supplied to a cleaning implement 44 for cleaning of cleaning elements 45, by means of which the udder and/or the teats of an animal are cleaned. In the further rinsing fluid line 43 there is also included a milk conductivity sensor 24. In the present embodiment, the cleaning elements 45 are designed as two spaced apart cleaning rollers 46, which, by means of a (non-shown) robot, can be brought under the animal's udder. During cleaning the teats are rubbed clean between the cleaning rollers 45 driven in opposite direction.

In the rinsing fluid line 43 there is included a venturi-element 47. The venturi-element 47 comprises a cylindric housing 48 including a supply nipple 49 and a discharge nipple 50. The supply nipple 49 extends into the cylindric housing 48 until the discharge nipple 50 and has a tapering end part 51. To the cylindric housing 48 there is connected, by means of a further nipple 52 and a further line 53, a tank 54 containing disinfecting fluid, such as chlorite. In the further line 53 there is included a computer-controlled valve 55. When it is desirable to clean the cleaning elements 45 with a chlorite-water mixture, such a mixture can be obtained by opening the computer-controlled valve 55. The water flowing through the venturi-element 47 realizes an underpressure in the cylindric housing 48, so that the disinfecting fluid present in the tank 54 is sucked into the cylindric housing 48 and is mixed with the water. By means of the conductivity sensor 24 the concentration of the chlorite-water mixture can be checked.

Adding acid or alkali to the rinsing fluid tank 16 is effected in a similar way as adding disinfecting fluid to the rinsing fluid line 43. For that purpose the line 32 branches off into a first line 56 and a second line 57, both debouching into the rinsing fluid tank 16. In the first line 56 and the second line 57 there is included a venturi-element 47, while in both lines 56 and 57 there are included computer-controlled valves 58. To the venturi-element 47 included in the first line 56 there is connected, via a line 59, a tank 60 containing an alkaline fluid, while to the venturi-element 47 included in the second line 57, there is connected, via a line 61, a tank 62 containing an acid. In the lines 59 and 61 there are furthermore included computer-controlled valves 63. By means of the conductivity sensor 24, included in the rinsing fluid line 17, the conductivity of the rinsing fluid can be determined. Then, by means of the computer 14, the concentration of acid or alkali in the rinsing fluid can be determined. The concentration of acid or alkali in the rinsing fluid is also determined by means of the milk conductivity sensors 13, which, near the teat cups 1, are included in the milk lines 2.

Claims

1. A method of determining the extent to which a milk line system is rinsed with a cleaning fluid, whereby in one or more places in the milk line system the electric conductivity of the cleaning fluid is measured, after which the purity of the cleaning fluid is defined.

2. A method as claimed in claim 1, characterized in that the electric conductivity is measured in places which are difficult to reach for the cleaning fluid and/or in places in the milk line system which are sensible to disturbances.

3. A method as claimed in claim 2, characterized in that the electric conductivity is measured in a line connected to a teat cup.

4. A method as claimed in any one of claims 1 to 3, characterized in that, on the basis of the results of the electric conductivity measuring, the concentration of the solvent present in the cleaning fluid is

determined.

5. A method as claimed in claim 4, characterized in that an alkali is added or will be added to the cleaning fluid and that the concentration of alkali is determined.

6. A method as claimed in claim 4, characterized in that an acid is added or will be added to the cleaning fluid and that the concentration of acid is determined.

7. A method as claimed in claim 5 or 6, characterized in that, after the concentration of alkali or acid has been determined, this concentration is compared with a predetermined value for the concentration of alkali or acid and that, when said value is not reached, alkali or acid is added to the cleaning fluid until the relevant value has been reached, while, when this value is exceeded, there is added cleaning fluid until the predetermined value has been reached.

8. A method as claimed in any one of the preceding claims, characterized in that, after the milk line system has been rinsed with the cleaning fluid, the milk line system is post-rinsed with a post-rinsing fluid and that, during post-rinsing, the concentration of alkali or acid in the milk line system is determined and compared with a predetermined minimum value for the concentration of alkali or acid, and the post-rinsing of the milk line system is only ended when the minimum value has been reached.

9. A method as claimed in any one of the preceding claims, characterized in that the milk line system is rinsed with a calibration fluid containing a concentration of alkali or acid known beforehand and that this calibration value is compared with the value of alkali or acid measured in the milk line system and that, when the measured value deviates from the calibration value, the means by means of which the electric conductivity of the fluid is measured are calibrated.

10. A method of determining the extent to which a line system is rinsed with a cleaning fluid, whereby in one or more places in the line system the electric conductivity of the cleaning fluid is measured, after which the purity of the cleaning fluid is defined.

11. An implement for applying a method as claimed in claim 10, characterized in that the implement comprises a line system with one or more conductivity sensors (24) included therein.

12. An implement for applying a method as claimed in any one of claims 1 to 9, characterized in that the implement comprises a milk line system with one or more milk conductivity sensors (24) included therein.

13. An implement as claimed in claim 12, characterized in that there are included one or more teat cups (1) in the milk line system.

14. An implement as claimed in claim 13, characterized in that there is disposed a milk conductivity sensor (24) in the milk line of a teat cup (1).

15. An implement as claimed in any one of claims 11 to 14, characterized in that the implement comprises a milking robot for automatically connecting teat cups to the teats of an animal respectively disconnecting same therefrom.

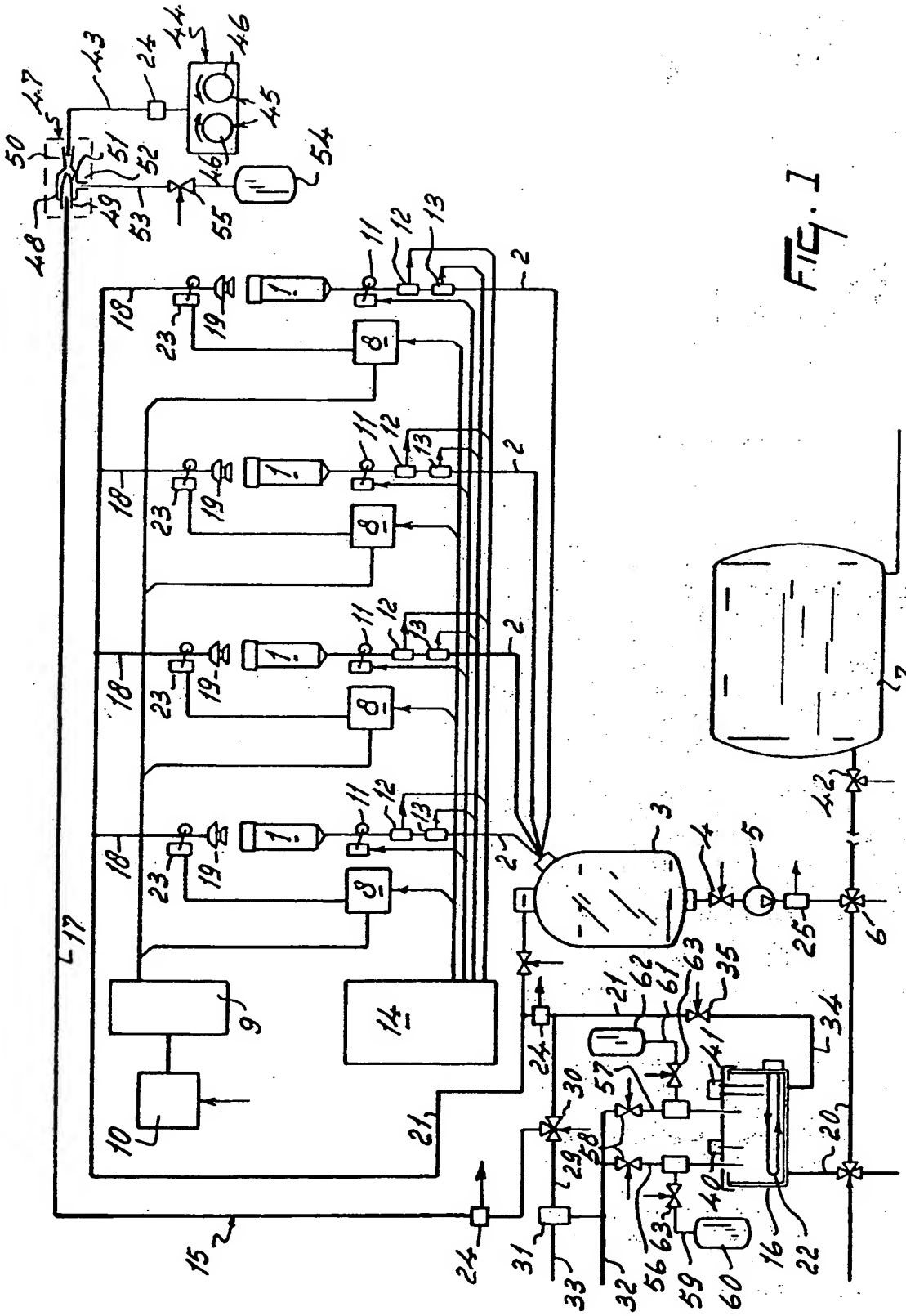

FIG. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 2430

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	US 4 015 618 A (SCHMID) 5 April 1977 * column 2, line 3 - line 23 * * column 2, line 35 - column 3, line 14 * * claims; figures *	1-4, 10-12 5-9,13, 14	A01J7/02 B08B9/03
A	DE 42 08 066 A (WILKE) 24 September 1992 * column 1, line 13 - line 45 * * claims; figures *	1	
A	DE 44 03 141 A (GEA TILL GMBH) 3 August 1995 * column 1, line 24 - line 65 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

A01J
B08B
B67C
G01N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 November 1996	Piriou, J-C

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